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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Carl L. C. Kah, Jr., *et al.*

Serial No.: 10/015,588

Filed: December 17, 2001

For: ROTARY DRIVE SPRINKLER WITH FLOW CONTROL AND SHUT OFF

Date: October 20, 2004

Group Art Unit: 3752

Examiner: HWU, Davis. D.

DECLARATION PURSUANT TO 37 C.F.R. §1.132

I, Carl L. C. Kah, Jr. declare and state as follows, under penalty of perjury:

1. I am Chief Executive Officer of K-Rain Manufacturing Corporation (K-Rain) of Riviera Beach, FL. K-Rain is a leading domestic and international manufacturer of professional and residential sprinkler systems.

2. I am making this declaration in support of the above-identified patent application, of which I am a joint inventor.

3. I am a 1953 graduate of Georgia Institute of Technology, with honors, in Chemical Engineering. From 1953 to 1959, I served in the U.S. Army Artillery. My military training included a 53-week Guided Missile Staff Officer Training Course, in which I graduated first in my class.

4. After retiring from the military in 1959, I joined Pratt & Whitney Aircraft in its Applied Research and Propulsion Division, where I served as the Deputy Program Manager for the U.S. Air Force's reusable rocket engine program, the predecessor to the engine used in the Space Shuttle.

5. While at Pratt & Whitney, I developed and patented a concept for an irrigation sprinkler system which I sold to Toro Corp., one of the major manufacturers of sprinkler systems.

6. In 1974, I left Pratt & Whitney to work full time on irrigation equipment, and set up K-Rain to manufacture and sell my patented concepts. I was president of K-Rain until 1986, when I turned the presidency of the company to my son. Since then, I have concentrated my attention on product design, improvement and innovation, and now hold over 50 patents related to irrigation systems. K-Rain's annual revenue is approximately $25,000,000, and growing rapidly. K-Rain currently employs over 200 people.

7. In the 30 years since I founded K-Rain, I have become thoroughly familiar the technologies employed in the industry, with the products of my competitors, and with the levels of skill in this art through regular reading of trade publications, such as "Irrigation and Green Industry", an official publication of the Irrigation Association; through involvement in the Irrigation Association, attendance at industry trade shows, and aggressive advertising programs to promote K-Rain's new ideas, and listening to the trade feedback. Further, as a patentee, and through close collaboration with my patent attorneys, I have become quite familiar with U.S. Patent Office practice and procedures, and with the standards for patentability applied by the U.S. Patent Office. The opinions stated in this declaration are all based on my knowledge and experience. In that connection, when I refer below a person "skilled in the art", I am specifically addressing the skill level possessed by one having "ordinary skill" in the sprinkler art.

8. I have studied and am familiar with the prosecution history of the above-identified U.S. patent application, and in particular with the claims pending in this application, with the outstanding rejections of the claims, and with the applied prior art. I am specifically aware that claims 8, 9, and 13, 35, 36, 41, 42, 47-49, 54, 55, and 60 have has been rejected as unpatentable over Walrath et al. U.S. Patent 6,109,293 (Walrath) in view of Tyler U.S. Patent 4,840,312 (Tyler), that Claim 34 has been rejected as unpatentable over Hruby U.S. Patent 3,323,725 (Hruby) in view of Cochran U.S. Patent 4,681,260 (Cochran), that claims 10, 40 and 53 have been rejected as unpatentable over Walrath in view of Tyler, and further in view of Lemkin U.S. Patent 4,538,762 (Lemkin).

The Rejections Based on Walrath and Tyler.

9. According to my understanding, in the opinion of the Examiner, it would have been obvious to a person skilled in the art to have modified Walrath by putting a removable nozzle as taught by Tyler on Walrath's outlet 30 to use Walrath's device in a sprinkler system. I respectfully disagree with the Examiner's opinion.

10. For one thing, the claims are directed to a sprinkler assembly, not a device for "use in a sprinkler system" as asserted by the Examiner. The device disclosed by Walrath is not a sprinkler or a sprinkler assembly, but a valve, and even though the patent suggests use of the subject valve in a sprinkler system (see col. 2, lines 53-65), a person skilled in the art would recognize that this suggestion is clearly related to controlling the flow of water through the system piping. It is not a suggestion to use Walrath's valve as a sprinkler *per se* nor as part of a sprinkler unit.

11. The only description in Walrath of outlet 30 is at col. 9, lines 64-66. This refers to "typical hose connections, hose bibs, and so forth as would be commonly known to those

in the industry," and it is exactly what a person skilled in the art would understand Walrath intends and is referring to. There is nothing anywhere in Walrath which suggests putting a sprinkler nozzle on outlet 30, or using the device itself *as a sprinkler*, or as part of a sprinkler.

12. Further in my opinion, there is nothing in Tyler which would motivate a person having ordinary skill in the art to put a nozzle on the outlet of Walrath's valve. Tyler's sprinkler doesn't even have a flow control valve, and nothing in Tyler suggests any reason for there to be one.

13. Most importantly, it is my opinion that a person having ordinary skill in the art would immediately recognize that Walrath's venturi device would be totally unsuitable for use as a flow control valve in a sprinkler head, (a) because a sprinkler head incorporating Walrath's valve would be unacceptably long, and (b) in the case of a gear drive sprinkler, the diameter of a drive shaft of a sprinkler head using Walrath's valve would be too large.

A Sprinkler Head Incorporating Walrath's Valve Would Require a Longer Drive Shaft.

14. The Walrath patent claims to provide flow control with increased flow rates and lower pressure drop. Referring to Fig. 2 of the patent drawings, this is accomplished because the effects of the constriction region on the upstream side 8 of interface (14) are compensated for by the expansion region on the downstream side 18 of interface 14. According to Bernoulli's principle, on the upstream side, there is a pressure loss due to the increase in flow velocity in the constricted portion. On the downstream side, as the fluid expands, and the velocity is reduced, there is recovery of the pressure loss. However, the expansion must be gradual. As those familiar with venturi devices know, and in fact, as stated in Walrath (see col. 9, lines 44-49; col. 13, lines 24-35), the angle on the expansion side must be 7 degrees or less to avoid flow separation and/or cavitation, with consequent reduced pressure recovery.

15. The problem addressed by this invention is to provide a shut-off valve in a sprinkler head which permits changing nozzles to achieve different flow rates without having to shut down the entire sprinkler system. If a person skilled in the art were to consider using Walrath's device as a shut-off valve in such an application, he or she would immediately recognize that the profile and dimensions of a venturi would have be selected to take account of the expected flow rates of the nozzles. In a typical sprinkler layout, there would be nozzles having flow rates ranging from about 1 gallon per minute to 12 gallons per minute, or even higher, e.g., 25 to 50 gallons per minute in some larger sprinklers with changeable nozzles, and even up to 100 gallons per minute for golf heads. If the venturi

throat were not sized to accommodate the higher flow rates, it would be choked, i.e., the pressure required to accelerate the flow to a velocity sufficient for the required flow to pass through the venturi throat would be higher than the available water pressure at the sprinkler inlet.

16. For example, to accommodate a flow rate 12 gallons per minute with typical available pressures, it would be necessary to provide a minimum throat diameter of about 0.3 inch. Because of the split venturi design, the internal valve diameter 24 on the downstream side must inherently be twice the maximum open size of the throat (plus an additional amount for overlap) to prevent leakage in the closed position. Therefore, diameter 24 would have to be between about 0.7 to 0.8 inch. As pointed out at col. 9, lines 35-44 of Walrath, the length to diameter ratio on the downstream should be 6:1, and preferably 8:1. Otherwise, the pressure loss from the constriction region could never be fully recovered. Thus, according to Walrath, for the required diameter, the length should be at least about 2 inches on the downstream side, plus the upstream length of the convergence side of the valve and its required seal. Higher flow rates would require a larger throat size, and correspondingly, a larger downstream-side diameter. Thus, the valve would have to be even longer to achieve reasonable pressure recovery. Those skilled in the art would be aware of the need to avoid valve designs which result in pressure loss as this can cause reduction of throw distance from the nozzle or other degradation of the spray pattern. Clark U.S. Patent 6,241,158, in the introductory section, and starting at col. 2, line 34, discusses this in some detail.

17. A person skilled in the art would recognize that a venturi valve designed to accommodate a reasonable range of flow rates would not fit in conventional sprinkler head for a gear drive sprinkler of the type shown in this patent disclosure, and up to 12 GPM flow, the nozzle drive shaft could be as small as ½ inch in diameter and ½ to ¾ inches long. Use of Walrath's type of valve would be rejected due to the disadvantages of having to increase the length of the sprinkler head. Not only would a longer head require costly redesign, but it would also be more costly to manufacture. It would also require that the system be buried more deeply in the ground, making installation more costly and inconvenient.

18. For the reasons stated above, it is my opinion that a person skilled in the art would not consider it obvious to construct a sprinkler head having a removable nozzle and an in-line shut-off valve constructed according to the Walrath patent.

The Diameter of the Drive Shaft of A Sprinkler Head Using Walrath's Valve Would Be Too Large.

19. Those skilled in the art know that in the case of gear driven sprinklers, it is desirable for the nozzle drive shaft have as small a diameter as possible. Increasing the diameter puts a larger load on the thrust bearing. Conventional sprinkler heads have drive shaft diameters in the range of 0.4 to 0.5 inch. Since the water must flow through the drive shaft, if Walrath's valve were used in a sprinkler head, internal diameter 24 would determine the minimum drive shaft diameter. A person skilled in the art would recognize that a drive shaft diameter of between about 0.7 to 0.8 inch as suggested in paragraph 16 above would not be as desirable as a smaller diameter shaft allowed by the valve types disclosed in my patent application. The bearing structure for the drive shaft would have to be larger and have more rotational friction to accommodate the larger load, and apart from design cost, the materials cost would increase. A person skilled in the art would try to avoid redesign cost size increases, and manufacturing cost increases, and would therefore not be and materials motivated to employ Walrath's venturi valve in a gear drive sprinkler.

Claimed Features Not Found in Walrath or Tyler

20. I respectfully call the Examiner's attention to the following recitation in claim 9:

> The sleeve valve is rotatable at least between a fully opened position in which the flow opening is aligned with the flow path to allow unobstructed flow through the nozzle housing. . .

This is not the case in Walrath. Even when the valve is open, sloping portions 36 and 40 obstruct flow path 12. In fact, a person skilled in the art would immediately recognize that Walrath's valve depends for its operation on such an obstruction.

21. I also respectfully call the Examiner's attention to the fact that claim 13 calls for a conical shaped sleeve valve. In my opinion, it would not be obvious to a person skilled in the art to make Walrath's valve conical. Indeed, since the operation of Walrath's venturi-type valve depends on the convergence and subsequent divergence of the flow path, making the valve conical would render it inoperative.

22. I further respectfully direct the Examiner's attention to several features of claim 35 which would not be found in a combination the teachings of Walrath and Tyler. For example, claim 35 recites a nozzle housing and a nozzle removably mounted in an outlet passage of the nozzle housing. In my opinion, a person having ordinary skill in the art would find no part in Walrath which can be called a nozzle housing having an outlet passage

in which a nozzle is removably mounted. The Examiner appears to have recognized this deficiency by his suggestion to attach a nozzle to valve outlet 30. A nozzle so attached would not be mounted *in a housing*, as called for by claim 35.

23. Claim 35 further requires that the nozzle housing (with the nozzle removably mounted in the outlet passage thereof) have a flow path therein, with:

> . . . a main portion extending along the central axis of the nozzle housing and an angled portion defining . . . [the] outlet passage . . . and a valve disposed in the nozzle housing flow path which is substantially coaxial with the nozzle housing flow path . . .

24. As I have stated above, Walrath does not have anything corresponding to a nozzle housing. Nor is the flow path in Walrath's valve substantially coaxial with a nozzle housing central axis. Figs. 2 and 3 of the patent clearly show that the flow path in Walrath is off the central axis at the interface 14. Further, in my opinion, to modify Walrath to meet this limitation of claim 35 would make the Walrath device inoperative.

25. Finally, claim 35 requires that the valve be:

> so constructed and configured that the parts thereof which control the water flow when the valve is not in the open position are substantially completely displaced from the flow path when the valve is in a fully open position.

26. In my opinion, whether interface 14 or angled portion 26 (or both) are considered to be the parts which control the water flow when the valve is not in the open position, a person having ordinary skill in the art would not consider either of these parts to be substantially completely displaced from the flow path when the valve is in a fully open position.

27. Like claim 35, claim 48 requires a nozzle removably mounted *in the outlet passage*, which is not present in Walrath, as explained above. Claim 48 also recites:

> a valve disposed in the nozzle housing which is operable between open and closed positions to control water flow between the main and angled portions of the nozzle housing flow path. . .

28. In Walrath, the angled portion of the flow path includes elbow portion 26. Even if this is read as a "nozzle housing flow path", in the closed position, water is not excluded from elbow 26. Nothing in Tyler remedies this deficiency.

29. Finally, claim 48 requires that the valve be:

> so constructed and configured that the parts thereof which control the water flow cause substantially no obstruction or turbulence in the nozzle flow path when the valve is in a fully open position.

In the discussion of claim 35 above, I demonstrated that both interface 14 and sloping portion 26 cause obstruction and turbulence. The valve relies on the downstream divergent portion to eliminate the turbulence.

The Rejections Based on Hruby and Cochran.

30. In summary, valve types such as preferred for in-line shut-off, and how they are incorporated into the nozzle housing of commercial gear driven sprinklers for optimizing size and performance, are important considerations which would lead one skilled in the art to reject use of Walrath's valve as an in-line shut-off valve for sprinklers according to the present invention.

31. From the Examiner's listing of the elements of Hruby (stationary housing assembly 91, nozzle housing assembly 103. 93, etc.) in Section 5 of the Office Action, I assume the Examiner is relying on the embodiment shown in Figs. 8-10 of the patent.

32. Claim 34 is directed to the combination of a sprinkler with a stationary housing, a rotatably driven head, and a shut off valve rotatably operable around a longitudinal axis. In my opinion, a person having ordinary skill in the art would not consider that Hruby shows a nozzle housing assembly which is mounted for rotation. Hruby's nozzle housing is threadedly attached in a fixed position on housing assembly 91. No person skilled in any mechanical arts would consider it reasonable to describe this as mounted for rotation, as asserted by the Examiner.

33. The Examiner appears to recognize that Hruby does not teach or suggest a rotating-nozzle sprinkler, but he seeks to remedy this deficiency by saying it would be

obvious to modify Hruby's sprinkler to give it a rotating nozzle as taught in Cochran. In my opinion, however, Hruby expressly teaches away from this. In reference to the embodiment of Figs. 8-10, at col. 7, lines 3-11, the patent suggests use of the water dispensing device (i.e., nozzle) 34 of the embodiment of Figs. 1-6. However, the quoted passage states that guide ribs 135 are provided to prevent nozzle 34 from rotating relative to housing 91. Similar ribs 74 are provided in the embodiment of Figs. 1-6.

34. I further declare that all statements made herein are made of my own knowledge and are true except for those statements based on information and belief, which I believe to be true, and further that these statement are made with the knowledge that willful false statement and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this declaration, this patent application, and any United States patent issuing therefrom.

Date: October 20, 2004

Carl L. C. Kah, Jr.